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Diodia kuntzei K. Schum (Rubiaceae, Spermacoceae): a new record for the state of Acre, Brazil

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Abstract

Diodia kuntzei (Rubiaceae, Spermacoceae) is prostrate herb, rooting at the nodes, with reddish stems, multifimbriate stipules, axillary one-two-flowered inflorescences, corolla with filiform tube, and indehiscent fruit. The species is recorded for the first time for the state of Acre, where it was found in Alto Juruá region, municipality of Cruzeiro do Sul, in waterlogged habitat (07°33′32″S, 072°42′59″W). Images of the plant and comments on its habitat and distribution are provided.

Keywords

Alto Juruá, flora, geographic distribution, taxonomy.

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Introduction

Rubiaceae is a well-represented family in the Amazonian state of Acre. Daly and Silveira (2008) reported 61 genera and 242 species, of which *Psychotria* L. (58 spp.), *Palicourea* Aubl. (21), *Coussarea* Aubl. (20), and *Faramea* Aubl. (18) are the richest taxa. The remaining genera have less than 10 species. Such records, however, have changed over the last years, increasing the number of the taxa for the state. Medeiros et al. (2014), as the product of a new floristic study, have added two more genera and 10 species.

Daly and Silveira (2008) mentioned only five genera among the species with herbaceous habit: *Spermacoce* L. with six species; *Geophila* D. Don with three; and *Psychotria* L., *Oldenlandia* L., *Sipanea* Aubl., and *Margaritopsis* C.Wright with only one each. According to Daly and Silveira (2008), there were no *Diodia* L. species in Acre. However, they listed two names, *Diodia ocymifolia* (Willd.) Bremek. and *D. hyssopifolia* (Willd.) Cham. & Schult., as synonyms of *Spermacoce ocymifolia* Willd. and *S. hyssopifolia* Willd., respectively. In contrast, Medeiros et al. (2014) listed those names under *Borreria ocymifolia* (Willd.) Bacigalupo & E.L.Cabral and *Borreria hyssopifolia* (Willd.) Bacigalupo & E.L.Cabral, respectively.

Diodia, as described by Linnaeus in 1753, is a genus native to the Americas, based on *D. virginiana* L. from

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the USA. It is composed of herbs with axillary inflorescences, four- or five-lobed corolla with a long slender tube, and indehiscent fruits; they are usually associated with palustrine habitats. The only taxonomic revision for the genus was published by Bacigalupo and Cabral (1999), in which five species were accepted, of which three occur in Brazil. However, these authors listed a only few specimens from some states, which reflects the need to increase the number of field collections and exhaustive work in regional herbaria. *Diodia kuntzei* K.Schum. is a widely distributed species in South America and was recorded for Venezuela, Peru, Bolivia, Brazil, Argentina, and Paraguay (Bacigalupo and Cabral 1999; Pereira 2007). In Brazil, based on available online databases (SpeciesLink 2019; Flora do Brazil 2019), this species grows in the states of Pará, Rondônia, Amazonas, Amapá, Mato Grosso, Goiás, Mato Grosso do Sul, Paraná, Minas Gerais, and Tocantins. In the present paper, we report *Diodia kuntzei* for the first time from the state of Acre in the western Brazil, in the Alto Juruá region.

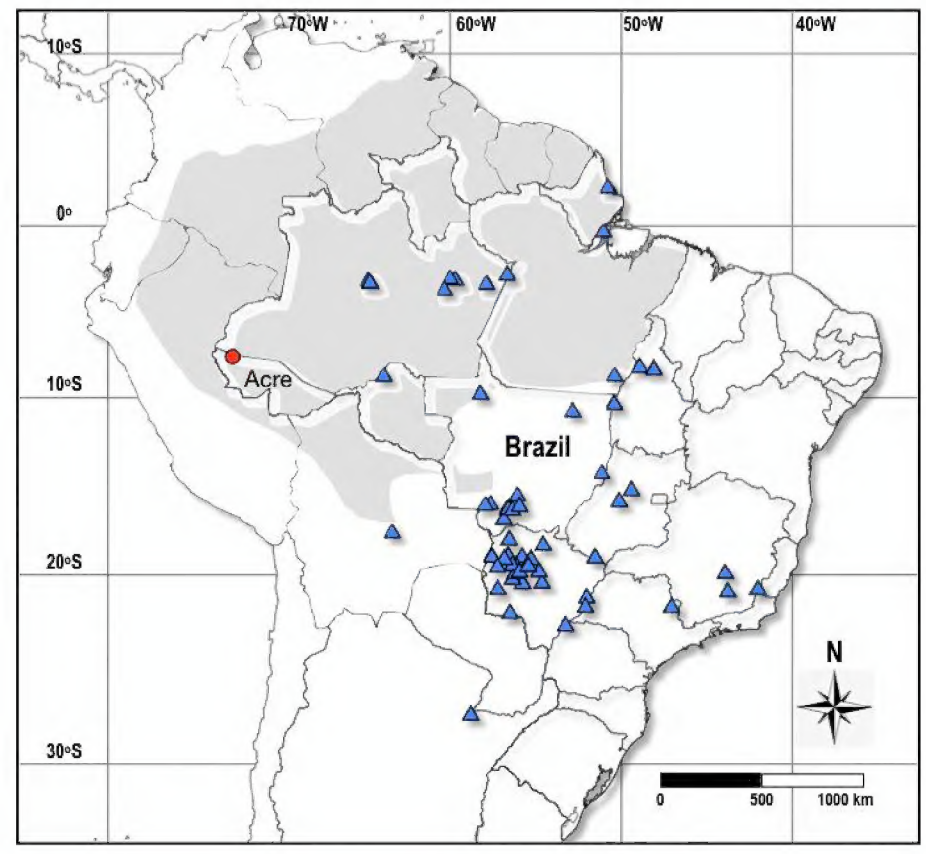

Figure 1. Geographic distribution of *Diodia kuntzei* in South America, and the Amazon Rain Forest distribution (light shaded), based on literature, REFLORA, and SpeciesLink records (blue triangles). The red circle indicates the new record from the state of Acre.

Methods

Conventional taxonomic techniques were followed. The specimens studied were collected in the natural areas of the Campus Floresta of the Federal University of Acre, municipality of Cruzeiro do Sul, in seasonally waterlogged open areas of flat relief (07°33′32″S, 072°42′59″W; altitude ca 240 m). The identification was made using the last taxonomic treatment (Bacigalupo and Cabral 1999) and by comparison with images available via SpeciesLink (2019) and Flora do Brazil (2019). The specimens were deposited in the Campus Floresta Herbarium (CFCZS) of the Federal University of Acre. The herbaria acronyms follow the standards of Holmgreen et al. (1990). To check the records of species geographic distribution we use data from REFLORA database among others (Bacigalupo and Cabral 1999; Zappi and Lima 2016; SpeciesLink 2019; Flora do Brazil 2019).

Figure 2. *Diodia kuntzei* **A.** Habit and details of margins and reddish veins of leaves. **B, C.** Details of inflorescence: flowers with pilose lobes and exerted stamens.

Results

***Diodia kuntzei* K.Schum.**, in Mart., Fl. Bras. 6(6): 15. 1888. "Lectotype: Paraguay, Asuncion, Habitat ad ripas fluvii: Paraguay, prope Assumption, Mar 1875, B. Balansa 1750 (P not seen, designated by Bacigalupo and Cabral 1999; isolectotypes BAF!, F!, P not seen, K!)".

New record. Brazil: Acre: Alto Juruá region: Cruzeiro do Sul: Universidade Federal do Acre: *Campus* Floresta (Fig. 1), in open, flat relief, and seasonally waterlogged areas (07°33′32″S, 072°42′59″W), Silva, C.P., 27 Dec. 2017 (18, CFCZS 603) (Fig. 2A–D); Souza, M.C., 15 Feb. 2018 (781, CFCZS 723).

Additional specimens examined (Table 1). BRAZIL • Amapá: between km 25 of BR 156 and Matapi, NW of Macapá, 16 Feb. 1979, Austin 7422 (INPA 97442). • Amazonas: Careiro, Rio Solimões, South bank, 10 km E of Boca de Janaucá, 3 Oct. 1973, Berg, C.C. 17589.0 (NY1061132). • Amazonas: Boca do paraná do Cambixe,

Table 1. Records of collections of the *Diodia kuntzei* in South America, included Figure 1. *New records.

Brazil state/country	Collection code	Collector no.	Latitude	Longitude
Acre*	CFCZS	603/723	−07.5589	−072.7164
Amapá	UEC	7422	02.2000	−050.8167
Amapá	IAN	27232	−00.3667	−051.0663
Amapá	HAMAB	1258	−00.3666	−051.0663
Amapá	HAMAB	274	−00.3666	−051.0663
Amapá	HAMAB	192	−00.3666	−051.0663
Amazonas	INPA	27	−02.8938	−056.6861
Amazonas	NYBG	13176	−03.4166	−057.9166
Amazonas	INPA	13176	−03.4166	−057.9166
Amazonas	US	13176	−03.42	−057.92
Amazonas	NYBG	23295	−03.1771	−059.7191
Amazonas	US	12074	−03.37	−064.7
Amazonas	INPA	12074	−03.3666	−064.7
Amazonas	US	29244	−03.23	−064.83
Amazonas	INPA	INPA3617	−03.1019	−060.0250
Amazonas	INPA	712	−03.1019	−060.0250
Amazonas	IAN	3617	−03.1019	−060.0250
Amazonas	IAN	712	−03.1019	−060.0250
Amazonas	INPA	51	−03.7680	−060.3692
Amazonas	INPA	23295	−03.7680	−060.3692
Amazonas	INPA	2977	−03.7680	−060.3692
Amazonas	IAN	1609	−03.3541	−064.7114
Argentina	IAC	16505	−27.486	−058.8176
Goiás	UB	294	−15.2981	−049.4267
Goiás	HUNI	619	−15.9344	−050.1403
Goiás	HUNI	620	−15.9344	−050.1403
Mato Grosso	SPF	7077	−14.3333	−051.1666
Mato Grosso	SPF	7077	−14.3333	−051.1666
Mato Grosso	US	1026	−19.50	−056.17
Mato Grosso	US	181/1-3	−16.40	−056.38
Mato Grosso	US	2773	−16.93	−056.88
Mato Grosso	HPAN	3304	−16.1316	−057.9822
Mato Grosso	CNMT	717	−09.8197	−058.2587
Mato Grosso	SP	CRONDON4678	−15.5961	−056.0966
Mato Grosso	UEC	3322	−16.2567	−056.6227
Mato Grosso	UEC	31	−16.2567	−056.6227
Mato Grosso	UEC	1058	−16.2567	−056.6227
Mato Grosso	UEC	891	−16.2567	−056.6227
Mato Grosso	UEC	3509	−16.2567	−056.6227
Mato Grosso	UEC	3175	−16.2567	−056.6227
Mato Grosso	UEC	2726	−16.2567	−056.6227
Mato Grosso	UEC	975	−16.2567	−056.6227
Mato Grosso	UEC	s.n.	−16.2567	−056.6227
Mato Grosso	UEC	01	−16.2567	−056.6227
Mato Grosso	UEC	2930	−16.2567	−056.6227
Mato Grosso	HPAN	987	−16.0706	−057.6789
Mato Grosso	CPAP	3013	−16.3602	−056.6166
Mato Grosso	CPAP	1886	−16.3833	−056.65
Mato Grosso do Sul	UEC	79	−19.535	−055.45
Mato Grosso do Sul	UPCB	3144	−18.995	−056.6244
Mato Grosso do Sul	UEC	3817	−18.9833	−056.65
Mato Grosso do Sul	COR	596	−19.15	−056.85
Mato Grosso do Sul	JPB	189	−19.5725	−057.2416
Mato Grosso do Sul	UB	526	−19.0166	−057.5833
Mato Grosso do Sul	SP	1815	−21.2558	−052.0369
Mato Grosso do Sul	MBM	5346	−20.4711	−055.7872
Mato Grosso do Sul	COR	526	−19.0047	−057.6017
Mato Grosso do Sul	COR	818	−19.0091	−057.6533
Mato Grosso do Sul	COR	575	−19.0091	−057.6533
Mato Grosso do Sul	MBM	60935	−19.0091	−057.6533
Mato Grosso do Sul	SPF	900	−19.0091	−057.6533
Mato Grosso do Sul	UPCB	4243	−19.0091	−057.6533
Mato Grosso do Sul	UEC	2135	−19.0091	−057.6533
Mato Grosso do Sul	CPAP	2236	−18.3666	−054.5833
Mato Grosso do Sul	CPAP	3620	−19.1616	−055.3
Mato Grosso do Sul	CPAP	2732	−19.0272	−055.8108
Mato Grosso do Sul	CPAP	5346	−19.85	−055.9666
Mato Grosso do Sul	CPAP	3316	−19.9266	−056.2177
Mato Grosso do Sul	CPAP	5764	−19.4833	−056.3833
Mato Grosso do Sul	CPAP	1299	−18.0666	−056.5666
Mato Grosso do Sul	CPAP	3144	−18.995	−056.6244
Mato Grosso do Sul	CPAP	60935	−18.9833	−056.65
Mato Grosso do Sul	CPAP	S/N.	−18.9833	−056.65
Mato Grosso do Sul	CPAP	596	−19.15	−056.85
Mato Grosso do Sul	CPAP	6874	−20.8	−057.2333
Mato Grosso do Sul	CPAP	09	−20.2406	−056.3783
Mato Grosso do Sul	CPAP	4243	−19.0091	−057.6533
Mato Grosso do Sul	CPAP	526	−19.0091	−057.6533
Mato Grosso do Sul	CPAP	683	−19.0091	−057.6533
Minas Gerais	BHCB	15085	−20.9388	−043.7908
Minas Gerais	UFG	47	−20.8083	−042.0297
Minas Gerais	BHCB	2501	−19.9207	−043.9378
Paraná	ICN	1650	−22.7722	−053.2668
Pará	NYBG	8873	−8.75	−050.42
Rondônia	IAN	14591	−8.7619	−063.9039
Bolívia	UB	3559	−17.6669	−063.4280
São Paulo	UEC	176	−21.77	−047.0800
São Paulo	UEC	168	−21.76	−052.1100
Tocantins	HUTO	1969	−8.3969	−048.1161
Tocantins	HUTO	s.n.	−8.3691	−048.1202
Tocantins	IAN	046	−8.2666	−048.95
Tocantins	IAN	046	−8.2666	−048.95
Tocantins	SP	4009	−10.3963	−050.4302
Tocantins	US	4009	−10.3964	−050.4303
Tocantins	NYBG	4009	−10.3964	−050.4303

clay soil, 22 Apr. 1976, Araújo, I.J. 2977 (INPA 55908). • Amazonas: Tefé, banks of Lago Tefé, 2 Dec.1982, Plowman 12074 (INPA125823). • Amazonas: Manaus, Cachoeira grande dos Bulhares, firm, sandy, humid soil, 16 Mar. 1956, Almeida, J.C. s/n (INPA 3617). • Amazonas: Parintins, várzea forest, Mamuru riverbank, 27 Jan. 2009, Galvão, A.K.L 27 (INPA 234707). • Amazonas: Paraná Urariá, between rio Maués-Açú and rio Apoquitaua, white water, 25 July 1983, Hill, S.R. 13176 (INPA 128628). • Amazonas: Manaus, praia da fábrica de gelo, riverbank, 17 Dec. 1958, Rodrigues, W.A. 712 (INPA 6860). • Amazonas: Careiro, lake near Botafogo head office, 4 Apr. 1970, Coelho, L.F. 51 (INPA 27999). • Amazonas: Tefé. Banks of Lago Tefé, 2 Dec. 1982, Plowman, S.N. (INPA 3033315). • Amazonas: Careiro, Fazenda Santa Terezinha, Costa Terra Nova, Ilha do Careiro, Rio Amazonas, 21 Feb.1975, Prance 23295 (NY 1061130). • Amazonas: Manaus-Porto Velho road, stretch between the rivers Castanho and Tupana, clay forest, 17 July 1972, Silva, M.F 835 (INPA 36926). •

Amazonas: s/d, Tsugaru, S. 836 (NY 1061170). • Mato Grosso: Poconé: road to porto cercado, murundum field, seasonally flooded, 28 Sept. 1992, Prado, A.L. 31 (UEC 122529). • Mato Grosso: seasonally floodable field, near km 18 of transpantaneira Poconé road, 3 Oct. 1991, *Berg 17589* (NY 1061132). • Mato Grosso: Poconé: floodable field, farm Tutu Falcão, 4 July 1991, Prado, A. 891 (UEC 122544). • Mato Grosso do Sul: Brasilândia Perus, Territorial São Paulo, 26 Nov. 1992, Catharino 1815 (HUEFS 31433). • Mato Grosso: Poconé: Jofre field, floodable area, dry, 11 Sept. 1991, Prado, A.L. 16 (UEC 122530). • Mato Grosso: Poconé, farm Santa Izabel, seasonally flooded field, 26 Mar 1992, Prado 3175 (UEC122547). • Tocantins: lagoa da Confusão. Ilha do Bananal, National Park of Araguaia, 25 mar. 1999, Mendonça 40090 (NY1067955).

Identification. Herbs, prostrate, rooting at the nodes, reddish stems, stipules 3–5 fimbriate, fimbriae pilose, reddish-vinous, ca 2 mm long; sessile leaves, elliptic, 9–17 × 2 mm, margins and midvein reddish-vinous; axillary one-two-flowered inflorescences; calyx 2-lobed, lobes ca 4 mm long, notoriously pilose; corolla white 17 mm long, tube ca 7 mm, 4-lobed, lobes 4 mm long; stamens fixed at the base of the corolla lobes, ca 5 mm long, anthers creamy, ca 1 mm long, style 17 mm long, bifid, stigmatic branches filiform. Dry fruit, indehiscent, obovoid, ca 6 × 4 mm, spongy pericarp, green, reddish-vinous when mature (Fig. 2A–D).

Discussion

The first record of *Diodia kuntzei* in Acre reflects the need to increase sampling (in all seasons of the year), even in well-collected areas where herbaceous plants occur, in northern Brazil. As the most widely distributed species of *Diodia* in South America, the occurrence of *D. kuntzei* in Acre was expected, based on the distribution model by Zappi et al. (2016), who used topographic and climatic data. Most of the herbarium collections mentioned above are more than 30 years old, and, in most cases, specimens are composed of only fragments. Therefore, new collections from new localities are necessary to assess this species' distribution.

According to Pott and Pott (2000) and Pivare et al. (2008), *D. kuntzei* is a pioneer amphibious macrophyte, which grows along the margins of lagoons and temporary inundated fields. Rocha et al. (2007) noticed an adaptive plasticity in *D. kuntzei*, occurring in all environments during the flood period.

Moreover, Rebellato and Cunha (2005), when evaluating the floristic similarity index between the rainy and dry periods, stated that *D. kuntzei* is a therophyte that predominates in both seasons, with cover values and relative frequencies of 17.19–8.80 and 17.35–10.49, respectively.

This species has also been reported as having an acaricidal activity against larvae of *Rhipicephalus microplus* Canestrini, 1888 with efficiency greater than 95% (Santos et al. 2013). Other authors reported that it is among the 286 forage species in the Nhecolândia subregion, Pantanal de Mato Grosso do Sul (Santos et al. 2002).

In this study, we present the most western record ever observed for *Diodia kuntzei*; the nearest previously known occurrence of this species is about 800 km. This leads us to conclude that although the diversity of Rubiaceae in the Alto Juruá region is known (Daly and Silveira 2008; Medeiros et al. 2014), new records are possible, mainly due to the size of the area and the paucity of studies at this time.

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Authors' Contributions

MCS collected and identified the specimen. AACF confirmed the identification. MCS, AACF, MS, and MVAL wrote and/or revised the manuscript. MVAL made the distribution map.

References

Bacigalupo NM, Cabral EL (1999) Revisión de las espécies americanas del género *Diodia* (Rubiaceae, Spermacoceae). Darwiniana 37 (1–2): 153–165.

Daly DC, Silveira M (2008) Primeiro catálogo da Flora do Acre, Brasil. EDUFAC, Rio Branco, AC, 555 pp.

Flora do Brasil (2019) Flora do Brasil 2020 under construction. Jardim Botânico do Rio de Janeiro. http://reflora.jbrj.gov.br/reflora/floradobrasil/FB32586. Accessed on: 2019–11–30.

Holmgren PK, Holmgren NH, Barnet LC (1990) Index herbariorum: part I: the herbaria of the world. International Association for Plant Taxonomy, New York, 683 pp. https://doi.org/10.1111/j.1756-1051.1983.tb01945

Linnaeus C (1753) Species Plantarum Impensis Laurentii Salvii 1: 104. https://doi.org/10.5962/bhl.title.669

Martius CFP von (Ed.) (1888) *Diodia kuntzei* K.Schum. Flora Brasiliensis 6 (6): 15.

Medeiros H, Daly DC, Silveira M, Obermüller FA, Daly DC, Silveira M, Castro W, Forzza RC (2014) Botanical advances in southwestern Amazonia: the flora of Acre (Brazil) five years after the first catalogue. Phytotaxa 177 (2): 101–117. http://doi.org/10.11646/phytotaxa.177.2.2

Pereira GF (2007) A família Rubiaceae Juss. na Vegetação Ripária de um trecho do alto Rio Paraná, Brasil, com ênfase na tribo Spermacoceae. PhD dissertation, Universidade Estadual de Maringá, Maringá, 68 pp.

Pivare MO, Pott VJ, Pott, A (2008) Macrófitas aquáticas de ilhas flutuantes (baceiros) nas sub-regiões do Abobral e Miranda, Pantanal, MS, Brasil. Acta Botanica Brasilica 22 (2): 563–571. https://doi.org/10.1590/S0102-33062008000200023

Pott VJ, Pott A (2000) Distribuição de macrófitas aquáticas no pantanal. III Simpósio sobre recursos naturais e socioeconômicos do Pantanal. Os desafios do novo milênio. EMBRAPA Pantanal, Corumbá, MS, 27 pp.

Rebellato L, Cunha CN (2005) Efeito do "fluxo sazonal da inundação" sobre a composição e estrutura de um campo inundável no Pantanal de Poconé, MT, Brasil. Acta Botanica Brasilica 19 (4): 789–799. https://doi.org/10.1590/S0102-33062005000400015

Rocha CG, Resende UM, Lugnani JS (2007) Diversidade de macrófitas em Ambientes aquáticos do IPPAN na Fazenda Santa Emília, Aquidauana, MS. Revista Brasileira de Biociências, Porto Alegre, 5 (supl. 2): 456–458.

Santos SA, Costa C, Souza GS, Pott A, Alvarez JM, Machado SR (2002) Composição Botânica da Dieta de Bovinos em Pastagem Nativa na Sub-Região da Nhecolândia, Pantanal. Revista Brasileira de Zootecnia 31 (4): 1648–1662. https://doi.org/10.1590/S1516-35982002000700007

Santos LB, Souza JK, Papassoni B, Borges DGL, Damasceno Junior GA, Souza JME, Carollo CA., Borges FA (2013) Efficacy of extracts from plants of the Brazilian Pantanal against *Rhipicephalus* (*Boophilus*) *microplus*. Revista Brasileira de Parasitologia Veterinária 22 (4): 532–538. https://doi.org/10.1590/S1984-29612013000400013

SpeciesLink (2019) Sistema de Informação Distribuído para Coleções Biológicas: a integração do Species Analyst e do SinBiota (FAPESP). Centro de Referência em Informação Ambiental-CRIA. http://inct.splink.org.br. Accessed on: 2019-08-09.

Zappi D, Lima IB (2016) *Diodia kuntzei* (v.1). In: Biogeografia da flora e dos fungos do Brasil. INCT Herbário Virtual. http://biogeo.inct.florabrasil.net/proc/6955. Accessed on: 2020-03-18.